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GROUSE DISEASE AND FOWL ENTERITIS.

The Etiology and Pathology of Grouse Disease and Fowl Enteritis. By E. Klein, M.D., F.R.S. (London: Macmillan and Co. 1892.)

IN this book Dr. Klein has given the results of an important series of researches made by him upon certain diseases in birds. The malady which has specially occupied his attention is that commonly known as the grouse disease. The book will therefore find a large and appreciative circle of non-professional readers. To all interested in the preservation of game it may be commended as furnishing for the first time an adequate and satisfactory explanation of the origin and mode of propagation of the grouse disease. The book is over and above that a valuable contribution to bacteriology. The very excellent illustrations appended enable one to follow the text with great ease. The birds affected are the red grouse (*Lagopus scoticus*) of our moors. The disease, when it breaks out in the spring or summer, is usually of a very virulent type. A fatal epidemic then arises which carries off large numbers of the birds, to the despair of the owners and keepers, who find themselves powerless to cope with the malady. It is to this quickly fatal epidemic that the name of the grouse disease is applied. Though much written about and much discussed, the origin of this disease has hitherto remained undiscovered.

During the last five years numbers of birds, dead or dying from the disease, were sent to Dr. Klein from moors in England and Scotland. The large amount of material furnished has enabled him to make an exhaustive inquiry.

The result is the most noteworthy account yet published of the etiology and pathology of the disease. Dr. Klein has proved that it is an acute infectious malady primarily affecting the lungs and liver of the birds. The symptoms and appearances are those of an acute infectious pneumonia. Dr. Klein has further discovered the *causa causans* of the disease in the shape of a minute unicellular organism, belonging to the class of the bacteria. This microbe has its special seat in the lungs and liver. It is a bacillus, and is found filling and blocking up the capillary blood vessels in the diseased areas of the lungs and liver. The organism can be isolated from the diseased tissues and grown on suitable media outside the body. In this way a series of culture of the bacilli were made on various soils—gelatine, Agar, beef broth, &c. The manner of growth of the microbe in these culture media is very fully described. The growths obtained were always of the same bacterial species. The pure culture of the bacillus subcutaneously inoculated into healthy animals reproduced the symptoms and appearances of the disease. They proved fatal to mice and guinea pigs, and caused in them a congestion of the lungs and liver. No effect was produced on pigeons and fowls. The most virulent cultures of the microbe were those grown in meat broth to which a piece of coagulated white of egg had been added. The most positive results were obtained with the common bunting and yellow-ammer. These birds were inoculated with a minute drop of a meat-broth culture of the microbe. They succumbed within twenty-four hours. The post-mortem appearances were similar to those found in the grouse, viz., a marked congestion of the lungs and liver. The bacilli were found in large numbers in the lungs. From these experiments Dr. Klein was able to conclude that the grouse disease is due to the microbe isolated by him from the diseased organs of the birds. Unfortunately he has not been able to reproduce the disease in large birds, or to utilize healthy grouse for his experiments. In the latter case the difficulty in obtaining living birds and keeping them in captivity prevented this last and most important proof being furnished. The larger birds experimented with (fowls and pigeons) proved unsusceptible.

The infection of the birds seems to take place through the respiratory organs. Dr. Klein furnishes a very striking experiment in support of this view. A yellow-ammer, after being inoculated with the grouse bacillus, was placed in a cage adjoining to one containing six healthy ammers. These six healthy birds acquired the disease and died.

The autumnal disease of the grouse is similar to the spring and summer disease, and both are caused by the same microbe.

The bacilli found in the autumnal disease are, however less virulent than those found in cases during the spring and summer. The buntings and ammers inoculated with the autumn microbe died at a much later period. Mice that had survived inoculation with the autumn microbe did not succumb when inoculated with the more virulent spring microbe. Dr. Klein suggests that cultures of the autumnal microbe might be used as a protective vaccine for the young birds on the moors. It is to be feared that those on whose shoulders this task would fall might prefer the disease to the cure.

The bacillus is easily killed. A temperature of 60° C. completely destroys its life in five minutes. On the other hand, virulent meat broth cultures heated for twenty minutes to 55° C., retained their virulence and yielded normal growths when grown in a fresh soil. This more prolonged heating so near the critical temperature for the bacilli (60° C.) did not, as one would have supposed, produce any retardation in their subsequent growth or any attenuation of the organisms.

Meat broth cultures, in which the bacilli had been destroyed by heat, produced in mice all the symptoms of the disease. This points to the presence in the meat broth of some poisonous chemical product. The matter is referred to very briefly, but we hope Dr. Klein will soon be in a position to tell us more about this interesting and important discovery.

To prevent the spread of the grouse disease the importance of weeding out suspicious birds from the moors is emphasized. The birds killed should be removed and burned.

Dr. Klein describes in the next place a bacillus which he isolated from garden earth. Guineapigs, rabbits, and mice, when inoculated with this organism, developed an œdema of the subcutaneous and muscular tissues. The organism is aerobic, and grows well in the presence of free oxygen, and on the surface of culture media. It is therefore not identical with Koch's bacillus of malignant

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œdema, which is an anaerobic organism. Though it resembles the bacillus of grouse disease in certain respects, they are not to be regarded as one and the same microbe.

The second part of the book contains an account of a fatal epidemic amongst fowls which broke out at Orpington in Kent. The symptoms and post-mortem appearances led Dr. Klein to designate the disease fowl enteritis, in order to distinguish it from fowl cholera. The bacillus which is the cause of fowl enteritis is not identical with the bacillus of fowl cholera, and Dr. Klein clearly proves this.

Dr. Klein's bacillus is evidently a less virulent organism. In only one case was the disease produced by feeding fowls with the intestinal contents of a diseased fowl. Experiments on other animals gave practically negative results, except in the case of one rabbit. The virulence of the bacilli was lessened by heat. Fowls inoculated with this attenuated virus could not be infected with the disease. Some practical suggestions are given with a view to combating such epidemics.

The concluding chapter of the book contains an interesting account of a disease in young pheasants known as "Cramps."

We have given but a very brief account of Dr. Klein's important investigations. The book will, however, be read by every one interested in the subjects of which it treats, and with great profit. To other workers in the same field it will prove an indispensable work of reference. We have only detected one misprint, on page 53, where "50° Fahr." should no doubt have read 50°C.

We cannot close this notice without a word of praise for the excellent photograms of Mr. Pringle and Mr. Bousfield.

A. M.

ELECTRIC LIGHT CABLES.

Electric Light Cables. (London: Whittaker and Co., 1892.)

A DOZEN years ago, when dynamos and lamps, both arc and incandescent, had been pretty well developed, the general public arrived at the conclusion that it was time to commence the work of central station lighting by electricity. It was not until the plans of these proposed works were taken in hand by the consulting engineers that the difficulties in the way of distribution became fully apparent. It was not well known what strength of current could be safely carried through the conductors; and engineers were rather appalled at the cost of the copper required for maintaining uniform pressure over a district, and at the waste of energy in the conductors. Besides these theoretical troubles in the way, engineers were met by the practical difficulty of devising a secure and efficient means of laying conductors under the streets, and ensuring their proper insulation. Until recently, the rules which must be attended to by engineers to enable them to handle these questions were only to be found in scattered pamphlets and Proceedings of societies. Several scientific men dealt independently with the heating of the conductors, and finally Mr. Kennelly published his splendid experimental work on the subject. Other writers went fully into the economical principles which must be followed in order to secure the most uniform distribution at the least cost. When the alternating-current rendered the employment of high pressures both safe and convenient, many of these precautions became less necessary, but new problems arose which are also generally dealt with only in isolated papers. Inventors sprang up, each advocating his own system of laying mains, and an outsider can gain a knowledge of these only by reading the patent specifications, or by inspecting the progress of works. The mechanical details of making joints, insulating, and so forth, are not much dealt with in the literature of the subject.

The book before us is one of the first attempts to collect all the above principles within one binding. The first few chapters deal principally with the heating of conductors and the economical laws of distribution. Well-known writings on the subject are here condensed into convenient compass, and Kennelly's experimental results are given in sufficient detail. Series and parallel systems and their combinations, including the three-wire and five-wire systems, which serve so much to economise copper, are explained, and also the principles involved in the use of transformers with alternating currents. Having thus described the systems available, we have, in Chapter v., a useful account of the cost of cables and conduits, with tables showing the relative cost of different systems when the distribution extends to different distances, showing the advantages of using high pressure for long distances. Chapter vi. gives a number of practical data about different kinds of conductors and the manner of making joints, which, though not exhaustive, will be of use to many. The next chapters deal with the characters of the insulation, including air insulation, lead-covered cables, the various bituminous compounds known as bitite, &c., oil insulation, and, of course, vulcanized india-rubber, about which the author is particularly capable of giving information. The effects of capacity, which has given so much trouble at some central stations, are also alluded to. These chapters are very fairly written, and give as good an account of the various systems of insulation as is likely to be found anywhere, or as we might expect in a volume of this size, which is more a hand-book of the subject than an exhaustive treatise. Some of the principles of testing are then shortly, but very clearly, described; and the principles of house wiring are clearly shown, and safety devices described. Several good chapters come near the end of the book on the practical construction of lines, whether overhead or underground, the latter dealing chiefly with the actual work which has been done in London of late years.

This book is one of the best which could be taken up by the student to give him a general knowledge of what is involved in the comprehensive title—"The Distribution of Electricity." It does not pretend to be a complete manual for the office, containing all the information required by the consulting engineer in dealing with these problems, but the descriptions are clear and generally accurate, and the only criticism which we feel compelled to make is that sometimes, apparently with the desire of preventing the book from being too technical, or requiring too much mental effort to read it, the author has been, perhaps, a little too sketchy, and might with advantage have given

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